



Designation: F 1974 – 00a

Standard Specification for Metal Insert Fittings for Polyethylene/Aluminum/ Polyethylene and Crosslinked Polyethylene/Aluminum/ Crosslinked Polyethylene Composite Pressure Pipe¹

This standard is issued under the fixed designation F 1974; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers metal insert fittings with split ring and compression nut (compression joint) and metal insert fittings with copper crimp rings (crimp joint) for composite pressure pipe. These fittings are intended for use in 125 psi (690 kPa) cold- and hot-water distribution systems operating at temperatures up to and including 180 °F (82 °C). (When used in polyethylene/aluminum/polyethylene systems the maximum operating temperature is limited by the pipe to 140 °F (60 °C)). Included are the requirements for materials, workmanship, burst pressure, sustained pressure, excessive temperature and pressure, temperature cycling tests, and markings to be used on the fittings and rings.

1.2 The values stated in inch-pound units are to be regarded as the standard. The SI values stated in parentheses are provided for information purposes.

NOTE 1—The tables show the “nominal size” in millimetres with the inch size in parentheses. This exception is made to harmonize the “nominal size” with the two pipe standards, F 1281 and F 1282.

1.3 The following precautionary caveat pertains only to the test method portion, Section 9, of this specification. *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

- B 16 Specification for Free-Cutting Brass Rod, Bar, and Shapes for Use in Screw Machines²
- B 62 Specification for Composition Bronze or Ounce Metal Castings²
- B 75 Specification for Seamless Copper Tube²
- B 140 Specification for Copper-Zinc-Lead (Leaded Red Brass or Hardware Bronze) Rod, Bar, and Shapes²
- B 159 Specification for Phosphor Bronze Wire²

- B 283 Specification for Copper and Copper-Alloy Die Forgings (Hot-Pressed)²
- B 584 Specification for Copper Alloy Sand Castings for General Applications²
- D 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing³
- D 1598 Test Method for Time-To-Failure of Plastic Pipe Under Constant Internal Pressure⁴
- D 1599 Test Method for Short-Time, Hydraulic Failure Pressure of Plastic Pipe, Tubing and Fittings⁴
- D 1600 Terminology for Abbreviated Terms Relating to Plastics⁵
- D 2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings⁴
- D 2240 Test Method for Rubber Property Durometer Hardness⁶
- E 18 Test Methods for Rockwell Hardness and Superficial Hardness of Metallic Materials⁷
- F 412 Terminology Relating to Plastic Piping Systems⁴
- F 1281 Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX/AL/PEX) Pressure Pipe⁴
- F 1282 Specification for Polyethylene/Aluminum/Polyethylene (PE/AL/PE) Composite Pressure Pipe⁴

2.2 ANSI Standards:

- B1.20.1 Pipe Threads General Purpose (Inch)⁸
- B16.18 Cast Copper Alloy Solder Joint Pressure Fittings⁸
- B16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings⁸

2.3 Manufacturers Standardization Society Standard:

- SP-104 Wrought Copper LW Solder Joint Pressure Fittings⁹

2.4 National Sanitation Foundation (NSF) Standards:

- Standard No. 14 for Plastic Piping Components and Related Materials⁹

³ Annual Book of ASTM Standards, Vol 02.02.

⁴ Annual Book of ASTM Standards, Vol 08.04.

⁵ Annual Book of ASTM Standards, Vol 08.01.

⁶ Annual Book of ASTM Standards, Vol 09.01.

⁷ Annual Book of ASTM Standards, Vol 03.01.

⁸ Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

⁹ Available from NSF International, P.O. Box 130140, Ann Arbor, MI 48113-0140.

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² Annual Book of ASTM Standards, Vol 02.01.

Standard No. 61 for Drinking Water System Components - Health Effects⁹

3. Terminology

3.1 Definitions are in accordance with Terminology F 412 and abbreviations are in accordance with Terminology D 1600, unless otherwise indicated.

4. Classification

4.1 This specification covers two classes of fittings, fittings with split ring and compression nut and fittings with a copper crimp ring, suitable for use with PEX/AL/PEX or PE/AL/PE pipe that meets the requirements of Specifications F 1281 and F 1282 respectively.

5. Materials and Manufacture

5.1 *Fittings*—The fittings shall be made from one of the following metals.

5.1.1 *Wrought Copper Fittings*—Wrought copper fittings shall be made from material meeting the requirements of Specification B 75 for one of the following coppers: copper UNS C10200, C10300, C10800, C12000, or C12200.

5.1.2 *Cast Copper Alloy Fittings*—Cast copper alloy fittings shall be made from material meeting the requirements of Specification B 584, copper alloy UNS C84400, C85700, C85710, or Specification B 62, copper alloy UNS C83600. When fittings are assembled with copper insert fittings, the insert fittings shall comply with 5.1.1.

5.1.3 *Cast Copper Alloy Valves*—Cast copper alloy valves shall be made from material meeting the requirements of Specification B 62 copper alloy UNS C83600 or Specification B 584 copper alloy UNS C83800 or C84400. When valves are assembled with copper insert fittings, the insert fittings shall comply with 5.1.1.

5.1.4 *Machined Brass Fittings*—Machined brass fittings shall be made from material meeting the requirements of Specification B 140 copper alloy UNS C31400 or Specification B 16 copper alloy UNS C36000, or Specification B 62, copper alloy UNS C83600.

5.1.5 *Forged Brass Fittings*—Forged brass fittings shall be made from material meeting the requirements of Specification B 283, copper alloy UNS No. C37700 or Specification B 124, Alloy UNS No. C37700.

5.2 *Crimp Rings*—Crimp rings shall be made from copper UNS C10200, C12000, or C12200. The crimp rings shall have a minimum allowable hardness of 35 and a maximum allowable hardness of 45 on the Rockwell 15T scale when measured according to Test Methods E 18.

5.3 *Split Rings*—Split rings shall be made from material meeting the requirements of Specification B 140 copper alloy UNS C31400, or Specification B 16 copper alloy UNS C36000, or Specification B 159 copper alloy UNS C51000.

5.4 The O-rings used on the brass fittings to make a static seal shall be manufactured from ethylene propylene rubber (EPDM) or silicone rubber (Si), with a Shore A durometer between 60 and 70 when tested in accordance with ASTM Standard D 2240.

6. Performance Requirements

6.1 *General*—All performance tests shall be performed on

assemblies of fittings and PEX/AL/PEX pipe. Fittings, split rings and crimp rings shall meet the material and dimensional requirements of this standard. PEX/AL/PEX pipe shall meet the requirements of Specification F 1281. Assembly of test specimens shall be in accordance with either 8.1 or 8.2, as applicable. Each assembly shall contain at least one joint. Use separate sets of assemblies for each performance test requirement.

6.2 *Hydrostatic Burst*—Assemblies shall meet the minimum hydrostatic burst requirements shown in Table 1 when tested in accordance with 9.5.

6.3 *Hydrostatic Sustained Pressure Strength*—Pipe and fitting assemblies shall not separate or leak when tested in accordance with 9.6.

6.4 *Thermocycling*—Assemblies shall not leak or separate when thermocycled 1000 cycles between the temperatures of 60 °F (16 °C) and 180 °F (82 °C) in accordance with 9.7.

6.5 *Excessive Temperature-Pressure Capability*—Assemblies shall not leak or separate when tested in accordance with 9.8.

7. Dimensions

7.1 *Dimensions and Tolerances*—The dimensions and tolerances of fittings, split rings and crimp rings shall be as shown in Figs. 1-3 when measured in accordance with 9.4.

7.1.1 *Alignment*—The maximum angular variation of any opening shall not exceed 1° off the true centerline axis.

7.1.2 *Fittings with Solder Joint Ends*—Solder joint ends shall be in accordance with ANSI B16.22, ANSI B16.18, or MSS SP-104.

7.1.3 *Tapered Threaded Ends*—Fitting threads shall be right-hand conforming to ANSI/ASME B1.20.1. They shall be taper threads (NPT).

8. Workmanship, Finish and Appearance

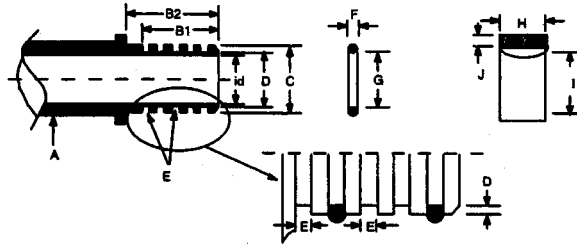
8.1 The sealing surfaces of the insert shall be smooth and free of foreign material. The fitting walls shall be free of cracks, holes, blisters, voids, foreign inclusions or other defects that are visible to the naked eye and that affect the wall integrity.

8.1.1 *Assembly*—Insert fittings shall be joined to PE/AL/PE or PEX/AL/PEX pipe by the use of either a crimp joint or a compression joint.

8.1.2 *Crimp Joints*—Crimp insert fittings shall be joined to PE/AL/PE or PEX/AL/PEX pipe by the compression of a copper crimp ring around the outer circumference of the pipe forcing the pipe material into annular spaces formed by ribs on the fitting. The dimensions and out-of-roundness of the crimp

TABLE 1 Minimum Hydrostatic Burst Strength Requirements for Fitting and PEX/AL/PEX Pipe Assemblies

Nominal Pipe Size, mm (in.)		Minimum Burst Pressures at Different Temperatures			
		psi at 73.4° F	(kPa at 23 °C)	psi at 180 °F	(kPa at 82.2 °C)
1216	(1/2)	870	(6 000)	580	(4 000)
1620	(5/8)	725	(5 000)	550	(3 800)
2025	(3/4)	580	(4 000)	465	(3 200)
2532	(1)	580	(4 000)	465	(3 200)



CRIMP JOINT FITTING DIMENSIONS

Dimension	1216 (1/2")	1620 (5/8")	2025 (3/4")	2532 (1")
A	Male and female copper solder or NPT thread ends—refer to clauses 7.1.2 & 7.1.3. This end of the fitting is a part of a coupling, tee, 90° elbow or adapter.			
id	0.334" ± 0.008"	0.452" ± 0.008"	0.610" ± 0.008"	0.0807 ± 0.008"
B1	0.591" Ref	0.591" Ref	0.591" Ref	0.591" Ref
B2	0.650" Ref	0.650" Ref	0.650" Ref	0.650" Ref
C	0.482" ± 0.004"	0.620" ± 0.004"	0.781" ± 0.004"	0.998" ± 0.004"
D (bottom of groove)	0.406" ± 0.004"	0.543" ± 0.004"	0.701" ± 0.004"	0.902" ± 0.004"
E	0.067" Ref	0.067" Ref	0.067" Ref	0.079" Ref
F	0.059" ± 0.003"	0.059" ± 0.003"	0.059" ± 0.003"	0.071" ± 0.003"
G	0.315" ± 0.008"	0.409" ± 0.008"	0.567" ± 0.008"	0.764" ± 0.008"

FIG. 1 Joint Fitting Dimensions

ring after it has been crimped shall be in accordance with Table 2.

8.1.2.1 *Crimping Procedure*—To affix the insert fitting to the pipe with the crimp ring, the crimping procedure shall be as follows: slide the crimp ring onto the pipe, insert the ribbed end of the fitting into the end of the pipe until the pipe contacts the shoulder of the fitting or pipe stop. The crimp ring shall then be positioned on the pipe so the edge of the crimp ring is 1/8 to 1/4 in. (3.2 to 6.4 mm) from the end of the pipe. The jaws of the crimping tool shall be centered over the crimp ring and the tool shall be held so that the crimping jaws are perpendicular to the axis of the barb. The jaws of the crimping tool shall be closed around the crimp ring, compressing the crimp ring onto the pipe. The crimp ring shall not be crimped more than once. Each crimp shall be checked to determine conformance to the after crimped dimensional requirements of Table 2.

8.2 *Compression Joints*—Compression insert fittings shall be joined to PE/AL/PE or PEX/AL/PEX pipe through the compression of a split ring, by an compression nut, around the outer circumference of the pipe forcing the pipe material into the annular space formed by ribs on the fitting.

8.2.1 *Compression Jointing Procedure*—To affix the insert fitting to the pipe with the split ring, and compression nut the procedure shall be as follows: slide the compression nut and split ring onto the pipe, insert the ribbed end of the fitting into the end of the pipe until the pipe contacts the shoulder of the

fitting or pipe stop. Position and compress the split ring by tightening the compression nut onto the insert fitting.

9. Test Methods

9.1 *Conditioning*—Condition specimens at 73 ± 4 °F (23 ± 2 °C) and 50 ± 5 % relative humidity for not less than 4 h prior to testing. Use Test Method D 618 to the extent possible as a guide to other conditions.

9.2 *Test Conditions*—Conduct the tests in the standard laboratory atmosphere at 73 ± 4 °F (23 ± 2 °C) and 50 ± 5 % relative humidity unless otherwise specified in the test methods or in this specification.

9.3 *Sampling*—Take a sample of the fittings, crimp rings and PEX/AL/PEX pipe sufficient to determine conformance with this specification at random.

9.4 *Dimensions*—Any randomly selected fitting or fittings and crimp ring or crimp rings shall be used to determine dimensions. Make measurements in accordance with Test Method D 2122. Determine the diameters by making measurements at four locations spaced at approximately 45° apart around the circumference. Inspection and gauging of solder joint ends shall be in accordance with ANSI B16.18, ANSI B16.22, or MSS SP-104.

9.5 *Burst Pressure*—Determine the minimum burst pressure in accordance with Test Method D 1599 on at least six joint assemblies, for each temperature in Table 1. The six joint